

Dzierzon, J. 1845. Gutachten über die von Hrn. Direktor Stöhr im ersten und zweiten Kapitel des General-Gutachtens aufgestellten Fragen. *Bienen-Zeitung* (Eichstädt) 1: 109-13, 119-21.

In the first volume of the *Bienen-Zeitung*, the monthly (later fortnightly) journal of the German Beekeeping Union, one Direktor Stöhr compiled into three chapters the various inquiries that had appeared in beekeeping journals in recent years, together with his answers, ending with an invitation to others to provide their own responses.

In the often-cited, little-read paper treated here, the Silesian clergyman and beekeeper Jan Dzierzon (1811-1906) responded to the first two of Stöhr's chapters of questions, leaving aside the third chapter on the management of honey bees. It was here that he first set forth his theory that female honey bees (queens and workers) come from fertilized eggs, while males (drones) come from unfertilized eggs. As a corollary, the queen bee had control over the sex of her offspring and could lay female and male eggs at will.

This radical idea evoked considerable skepticism, as nothing of the sort was known from any other animal. Still, if true, it would explain a number of puzzles that had been noticed since the time of Aristotle. It was vigorously debated in the ensuing period, coming to be generally accepted within 20 years. Furthermore, over about the next 70 years it was extended to the Hymenoptera as a whole and is now known as Dzierzon's Rule. It is, as far as I know, the earliest proposed sex-determination mechanism that is today regarded as true.

Dzierzon also here addressed other questions in such a way as to provide a new, much firmer basis for honey-bee reproductive biology as a whole. Many of his fundamental findings are now so much taken for granted that it is hard to realize the great confusion that surrounded this subject prior to the period in question.

The translation below is intended to make Dzierzon's paper more widely accessible. It is not copyrighted and may be freely quoted or reprinted. Except in the few cases where Dzierzon repeats Stöhr's original question, this is placed in square brackets before Dzierzon's answer. I thank Alfred Dietz for calling this paper to my attention, Ted Schultz for going to the trouble to get me a copy, and Don Cameron for advice in the classics.

Christopher K. Starr
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RESPONSES TO DIR. STÖHR'S QUESTIONS IN CHAPTERS 1 AND 2 OF THE GENERAL INQUIRY

As friends of the honey bee and beekeeping enthusiasts, we are indebted to the *Bienen-Zeitung's* esteemed editors for endeavouring to bring our widely dispersed community closer together in spirit. It behooves us all to assist in this enterprise by contributing our questions and ideas. On page 59 of issue no. 6, beekeepers are asked to send in responses to questions posed there and in previous issues. It is my pleasure to attempt some answers.

Chapter I

[Omitted. This part, making up about 20% of the paper, treats six questions about the best design

of the bee yard and hives. Although Dzierzon had designed an improved hive -- and had necessarily solved the problem of the bee-space in doing so -- L.L. Langstroth's superior design soon rendered it obsolete, even if this was not widely recognized in Central Europe for some time.]

Chapter II

It is with much greater interest that I now turn to questions posed in Chapter 2, having to do with the natural history of honey bees. In this area, it is not only possible but altogether necessary that beekeepers should reach a common understanding. Correct conclusions can only be reached on the basis of exact observations and a willingness to set aside long-held views and preconceptions that do not agree with the facts.

1. How many kinds of bees are found in the hive?

Just three kinds are known: a) the queen as the perfect female, b) the working bees; these are incompletely developed females that, nonetheless, have full developmental potential while still in the egg or as young grubs, and c) the drones, or males. I have never found the so-called black bees -- about which so much has been said -- emerging as such from the cells. As anyone can see from direct observation, young workers all look alike when they first emerge. Only through age, differences in activities and the particular circumstances in which they find themselves do some bees take on a different colouration from others.

For example, shut-in bees that are greatly agitated, so that they make violent efforts to get out of the hive for the first time, can become rather blackish through overheating and rubbing of the body surface. Every robber bee is blackened through frequent entry into honey cells and especially from being touched and licked a great deal by nestmates, as she returns home not only with honey in the crop but also smeared with it. Robber bees also try to push their way into other hives through crevices, which causes yet more hair to be rubbed off.

It is alleged that foraging bees inevitably take on a blackish tone, although I have not personally noticed this. If this is in fact the case, it could likewise be due to crawling in narrow spaces, especially in the rough and tumble with other bees inside the hive. Alternatively, it may be mostly older, relatively hairless bees that become foragers in the first place. After all, the workers tend to undertake different activities at different times of their life, even as they remain capable of any task in an emergency.

Young bees take care of business inside the hive. They feed the brood, produce wax, build cells, and when they fly out they tend to collect pollen. In contrast, older bees -- which can be recognized by their worn wings and greyish body colour -- do not concern themselves with inside tasks but occupy themselves mainly in the collection of honey, continuing for as long as their wings will still carry them. Older bees do not even concern themselves as much with the queen, who is always attended by the young bees. These latter are the first to become agitated when the queen is removed or otherwise absent from the hive, and it is they who turn to rearing a new queen. This will only work if there is brood present, so that any hive that has remained queenless for too long must be supplied not only with young brood from other hives but with pupae and even young worker bees if one is to keep it going. From the change in the hive, or even just in the queen, these young bees recognize the new queen as foreign to them and will often kill her, especially if she is young and they are accustomed to an older queen. An unmated queen is usually killed and disposed of without delay.

In summary, then, my close observations lead to a distinction among worker bees only on the basis of age. I have no knowledge of any "black bees", which are ostensibly driven out with the drones, and I think reports of them must be due to confusion with robber bees or to simple errors in observation.

2. Do any bees other than the queen lay eggs?

Other laying bees are certainly found in some hives, if not in all. In a very weak hive that I had put together by attaching a queen cell to some combs in a crate and shaking into it a handful of bees, I once found evidence of just such a laying bee, indistinguishable from her nestmates in external physical aspect. Before the new queen had emerged, the cells already contained many eggs, all of which developed into drones. I have often found drone eggs in established hives that had either become queenless or in which a new queen had not yet begun to lay. In such a case, where the eggs come from a worker, they were always found in drone cells if any were available. It may be inconvenient for workers to lay in the smaller worker cells, on account of their shorter abdomen and the hindrance posed by the wings. Laying workers vary in their degree of development, so that some are attended as if they were queens.

I once placed a virgin queen in a hive that I had confirmed by careful search to be queenless. She was immediately killed. I replaced her with another who was already fertile. This one lived only so long as she remained enclosed. Finally, I united the hive with another, strong one. This was in the fall, and in the spring the hive was again queenless. The laying worker -- with all the passion of a true queen -- presumably stung the introduced queens to death. Or it may be that other workers did the deed under the impression that the colony already had a queen. If the latter is the case, a practical remedy seems hardly possible. While a failing queen can usually be driven out, in this case there is no alternative to fumigation, much as one relucts to resort to such extreme measures.

In some situations, on the other hand, laying workers are treated no differently from other workers, so that the colony eagerly accepts a virgin queen or sets to rearing new ones. In either case, the new queen mates, and the colony returns to normal, as I have seen happen this year.

The mother queen having left the hive, drone brood from a laying worker is carefully tended and collectively brought to maturity. These drones are identical to those arising from queen-laid eggs, and even those that are reared in the smaller workers cells appear to be complete and capable of mating. After all, the smaller queens that are indistinguishable from workers except in colouration can become fertile and so are evidently capable of mating. Why should it be any different with small drones?

3. [If there are just two sexes of bees, or only male and female eggs, how is it that we find four physically distinct kinds of bees in the colony?]

This question has already been answered above. I know only one kind of working bee and no intermediate forms between these and queens. Transitional cells in the comb are evidently unsuited to brood rearing. Most such cells are four- or five-sided and are only useful for storing honey. Only cells that are very close to regularly hexagonal are used for rearing workers or drones, according to their size.

The egg-laying capacity of some workers is not, in my view, a result of developing in somewhat larger cells. Rather, it seems more likely to result from their having received as larvae

small superfluous amounts of the special food that is normally placed in queen cells. In my experience, queen food is usually deadly to drone larvae. I have almost always found any such larvae in royal cells dead and decomposed. Any queen food given to female larvae, on the other hand, can only raise their level of perfection, on account of their potential to become queens.

4. [In my experience and that of many other beekeepers, only about two queenless colonies in ten are found to produce a mass of drones. How can we explain this?]

As seen in the foregoing, I must disagree in large part with the view expressed in this question. The results that I am about to present are the fruit of very careful investigations, in the cause of which I have even sacrificed several good hives of bees, such was my eagerness to solve the particular puzzle. After some years, I believe I have done it.

Here for the first time I will publicly lay out my views for the consideration of all bee specialists. I do not address myself to those who, having bought one or two hives and leafed through a few popular beekeeping magazines, regard themselves as accomplished beekeepers. The direct experience of such persons hardly goes beyond recognizing that to go near their hives without wearing a bee-veil and gloves is to risk painful stings, yet they deem themselves qualified to sit in judgement of the most exacting observations. Their opinion having no weight, it will not concern us here. I am, however, very much concerned to bring knowledgeable beekeepers around to my point of view and will certainly give their questions and criticisms all due attention.

Here and in succeeding issues of this journal, I will maintain that a) the queen must be fertilized by a drone if she is to be fully functional, and b) mating takes place in the air, but that c) drone eggs require no such fertilization, while drone participation is absolutely necessary in the production of working bees.

While in the higher animals the male is the more developed and dominating sex -- e.g. as the bull holds his herd together and rules over it, while the cock does the same with his hens -- we find the opposite situation among the insects. In wasps, hornets, bumble bees, ants and especially the honey bee, the perfect female forms the focal point and cohesive force of the colony. Just as the drones are subordinate to the queen, so are they by nature imperfect beings, the rearing of which requires less energy and material than in the production of a queen or worker. (In the characterization *fucus* the ancients seem already to have understood this.¹) The truth of this assertion follows from the simple and obvious principle that anyone capable of large and difficult tasks can accomplish the smaller, easier ones. Similarly, any hive in a condition to produce workers can certainly produce drones, provided that there are available cells of the right size, although the reverse does not follow. Mating does not fertilize the brood cells but the queen's spermatheca. This latter is the little bladder or knot that is filled with a watery fluid in virgin queens. When it is supplied with semen, it takes on a markedly whitish colour.

Ordinarily, egg comb remains inactive until after mating has taken place, but this is not always the case. While some unfertilized queens lay no eggs at all, others may lay drone eggs, as may even workers bees. The latter I regard as entirely incapable of mating on account of the lack of a spermatheca. I am persuaded that worker-laid eggs give rise to drones only, while those from which queens and workers develop must first enter into contact with the sperm-filled spermatheca.

To be sure, this is simply a theory and will remain as such. Still, the careful observer no longer withholds his approval from Copernicus's heliocentric theory of the universe, and my theory deserves no less. It allows us to make sense of all of the most puzzling occurrences in the hive.

Among other things, it allows us to account for the observations that virgin queens with defective wings lay only drone eggs, and that a previously fertile queen is reduced to laying only drone eggs if her sperm supply is exhausted, and -- which I regard as the greatest enigma of all -- how the queen, who as a rule is the sole source of the colony's eggs, can know whether a particular egg will become a worker or drone.

In fact, she does not so much know as have the capacity to determine which kind of bee it will become. If it will become a worker, the egg comes in contact with the spermatheca. If a drone, it does not. Prevention of such contact seems to be associated with the greater size of drone cells, which gives the queen more freedom of movement. Can anyone remain unawed by the Creator's wisdom in affording the queen this ability? While this would be of no use to the females of other animals, it is indispensable to the honey-bee queen, who must regularly and without interruption keep the brood cells supplied with eggs, each according to its type. The spatial and temporal relationships between worker and drone brood can vary a great deal. If we experimentally remove the entire drone comb and put worker comb in its place, a fully fertile queen will only lay worker eggs in the new cells. If circumstances demand it, she can lay drone eggs during the cold of January and February and then stop producing them in May and June, when the greatest warmth reigns over the hive. The hypothesis of two distinct broods combs regulated by temperature and other external effects does nothing to clear up this puzzle.

All truly knowledgeable beekeepers and exacting observers are respectfully invited to submit any reasoned objections that they may have to this theory, which, I repeat, is based on years of study and published here for the first time.

5. [What is the nature of the drones?]

Anyone who still doubts that drones are males whose function is to fertilize the virgin queens will find this proven in no. 7 below. The question under consideration here is whether the drones have any secondary function.

The answer is an unequivocal "No". They sit around, consuming the colony's provisions, and on every fine day when it is sunny and warm they venture out to be of service to any queen on her mating flight. That is their one purpose in life. That they are so numerous -- up to several thousand in a hive -- is one of Nature's wise provisions. In the case of an isolated colony, if there were only one or a few drones available for a new queen, her fertilization would depend on the greatest good luck. For a colony that will not re-queen in a given year, drones are entirely superfluous, as the queen is fertilized for life on her mating flight, and some weak colonies do not produce a single drone. However, if this does occur in some others it is evidently because the bees cannot be sure that sustained good conditions may not make it advantageous to swarm. Alternatively, the queen may suddenly be lost. For this reason, colonies with old queens are especially given to the building of drone comb. Because drones serve no other purpose, it is advantageous to prevent the production of drone brood, for example, at the start of comb production. The bees may also carefully remove any transitional cells, as well as replacing any existing drone comb with worker comb, so that there is nowhere to lay drone eggs.

Despite the best of precautions, a small fraction of hives will produce such a quantity of drones that any virgin queen in readiness for the mating flight can always meet with at least a few of them around midday, whether from her own or another colony. If Schirach and others had considered this, they would not have maintained that the queen is at once virgin and a mother. This example

can serve as a cautionary lesson to us all of the ease with which false conclusions can arise from the misinterpretation of experimental results.

6. [As a rule, how many drones are found in a colony?]

The quantity of drones depends on the number of available drone cells, at least of those found in the middle part of the hive. Peripheral brood combs can remain unoccupied, even while those in the interior are in constant use, cell by cell.

Variation in the number of drone combs and cells within a single hive over time depends on the season and the particular circumstances. Before the swarming season, when the warmth and humidity are favourable to the brood, the bees are very much inclined to construct drone comb and often switch from making worker cells to drone cells, but rarely the reverse. And a queenless colony builds almost nothing but drone comb, if it is strong enough to build anything at all.

In contrast, a colony provided with a young, recently fertilized queen in the same season will tend to build no new drone comb and may convert existing drone cells into worker cells. This explains why such colonies usually have such beautifully structured nests and enjoy strong, orderly, well-timed afterswarms. Accordingly, anyone wishing to renew old brood comb should do so at this time, in the fourth week after swarming or absconding.

7. [Where does mating take place?]

In response to those who dispute the fact of the queen flying out and mating in the air, I would like to make the following suggestion. In next year's swarming season, hive an afterswarm that has chosen a new nest site and settled down, and take it at night to a previously chosen site. After a week, when the weather is fine, drive out and capture the queen, being careful to set the hive back down exactly where it was. Then release the queen at a distance. If you then see her fly back to the hive, straight as an arrow, I would like you to explain to me how the queen knows where her hive is if she has never flown out of it.

If you should then object that the queen might just have flown out for her own pleasure, let me propose another experiment, although it may cost the entire hive, while the foregoing will at most cost the breakup of the existing combs. After determining beyond any doubt that a hive contains just one queen, and she a virgin, cut off her wings. I will wager \$100 against one cent that she will never be fully fertile. Because the possibility remains of mating in the air during swarming, the virgin queen must be caught and her wings cut off as she leaves to swarm or as you drive her out of the maternal hive.

While I by no means impugn the honesty of anyone who assures me that a queen who emerges from the cell with defective wings can be fully fertile, I maintain that he is just as deceived as was Shirach. Either an older queen was mistaken for a virgin with wings already frayed, or there was another queen present that had had her wings damaged in a fight when she was already fertilized. Like Doubting Thomas, I must say that unless I see it with my own eyes I do not believe that mating can take place inside the hive. It flies in the face of all analogy. If male and female ants -- even though the workers are wingless -- make their mating swarms in the air, and if bumble bees mate in flight, as I have observed directly, should we really believe that it is different with the honey bee, which swarms almost unceasingly in the air? Now, I have not personally witnessed the act, and it would be hardly possible for anyone to do so. (This is a sticking point on both sides of the argument.) The queen, as I have observed a hundred times, quickly rises up to a great height, where

she encounters drones and will be less disturbed by the buzzing mass of workers that is densest at this time.

On four occasions I have received substantial evidence of such encounters. Once I saw the queen come back with the tip of the abdomen held wide open. I was unable to capture her at this point, as I first noticed her crawling into the hive entrance, so I had to up-end the hive (a straw skep) and drum out the bees in order to expose the queen. I then found attached to her a drone's organ, such as anyone can see by simply squeezing a drone hard around the middle. As soon as that is done, the drone is motionless and dead. We may presume that this also happens in mating. For this reason and because of the great stickiness of this organ, a firm obstruction may fairly often be formed, resulting in the loss of some queens who are not strong enough to tear it free. I saw a virgin queen fly out in the best of spirits in very fine weather a few days ago; she did not return, however, even though she could hardly have lost her way, and I soon noted the expected outbreak of unrest in her colony. This was only stilled upon the introduction of new young brood in the hive.

Another queen, which returned to the hive with a similar abdominal obstruction, had already rid herself of it when I examined her the next day and appeared to be fully functional. I removed a third such queen from a box hive with the tip of a pen knife and saw that she was just like the first queen mentioned above. This one began to lay eggs a few days later. And in a fourth case I found the drone organ already quite hardened in the queen of a hive that still showed no sign of new brood in March. The organ had evidently been in place since the previous autumn. I removed this organ, but the queen remained infertile, although she seemed to be in good condition, so that after a time I removed her and merged the colony with another.

While mating in flight can now be accepted as a demonstrated fact, certain associated features must still be regarded as semi-independent phenomena. Among these are the flight far from the madding crowd and sitting amid the constant bustle of bees. I permit myself to conclude on the basis of the present evidence that we can set aside any suggestion that mating takes place inside the hive.

Thus, no virgin queen can ever become functional unless she is flight-worthy. Similarly, it has recently come to my attention that a young queen with an injured hind-leg remained infertile, even though she was able to fly out, presumably because she could not grasp the drone and achieve the necessary physical connection. In contrast, even though the more common injuries to the fore- and mid-legs clearly result in diminished reproductive success, they do not entirely incapacitate a queen from producing brood.

8. [What should we make of the view that the queen necessarily remains unfertilized if she is prevented by inclement weather from mating in the air?]

This has already been answered above.

9. [How many distinct kinds of cells are there in a mature nest?]

The examination of any abandoned nest will answer this inquiry.

10. [What is the origin of honey and wax?]

The raw material for wax is unquestionably pollen mixed with honey, the very same that serves as food for larvae and adults.

As the amount of young brood increases, comb construction is accelerated. It stops as soon as

the production of new brood ceases. If those bees engaged in brood care are excluded from the brood comb, they quickly turn to building new comb, having lost access to the brood and having no other outlet than wax production for the food they take in. If we form a new colony by replacing a strong colony with an empty hive, into which a queen is introduced, so that returning foragers enter the empty hive, it will not grow as quickly, at least at first. This is the case even if the new colony has more workers and a greater food intake. Wax being a sort of fat secreted by the bees, it is more abundant if the bees are better fed. The queen and drones feed on the purest, clearest honey. The workers in winter are in a semi-comatose state, with all activity suspended beyond that needed to maintain life, at which time they also feed on honey, while in the full activity of summer they eat pollen mixed with honey.

Both adults and brood can, in fact, subsist for a time on nothing but honey. However, the eagerness with which the workers seek and collect pollen that is set out for them, whether at the start of the day or with the lifting of inclement weather, shows that they cannot get by for long without pollen, even when nectar is superabundant. So great is their need for pollen that they will even accept a rough, impure mixture of it if they have for a time been fed nothing but fluids.

11. [What is the development period of bees from egg to adult?]

A developmental period of 21 days for an ordinary worker bee does not seem too short to me. Aside from the fact that young bees only start to become active on the third day after emergence, when their wings have reached a state of physical maturity, I seem often to have seen preliminaries to this on days 22 and 23.

12. [How does the process of colony division known as swarming take place?]

The most immediate cause of the queen's mating flight or her participation in swarming is the presence of queen cells, if one or more are already capped. The workers prepare these when it is unusually hot inside the hive, as a sort of innate premonition tells them that the queen is about to leave the hive.

It seems to me that a shortage of cells by itself under moderate temperature is insufficient to bring about the division of even a very strong colony. With very nectar-rich forage, the production rate of brood must remain low, and no swarming takes place unless the other conditions are especially favourable. Given the brood's demands, an increase in warmth inside the hive and very humid or rainy weather -- in which the bees collect a great deal of pollen and watery nectar -- leads to frequent swarming, often to the considerable detriment of the colonies. Because the inside temperature is in part dependent on the construction materials of the hives, these can have a significant effect on the swarming tendency. Swarming takes place much more readily from warm skeps than from the cooler box hives, and more readily if the hive is exposed to direct sunlight or otherwise in an especially warm location. Even if a part of the colony should be ready and willing to fly out as an afterswarm with a virgin queen, a certain moderate degree of warmth is needed. Only under these conditions does the colony reach the necessary strength, while at lower temperatures it tends toward the elimination of excess queens.

13. [What is meant by virgin-queen swarming?]

This is mainly a semantic question. In normal usage, I believe, "swarm" can refer to any swarm, regardless of the age of the mother queen.

I have only once, in 1835, known a young queen to participate in a second swarm in the same year. It is noteworthy that this particular queen had injuries to most of her legs. Most likely, the workers, having recognized the queen's physical handicaps after she had laid the first eggs, had produced new queens and forced the handicapped queen into swarming. Because she came from an established colony, the evidence was circumstantial, and a closer investigation could not be undertaken. The mother hive was in good condition in the succeeding period.

14. [How long does it take a virgin-queen swarm to become well established?]

Inasmuch as virgin-queen swarms are very uncommon in the district in question, I can report nothing about their duration from first-hand experience. It does seem, however, that aside from the quality of the forage, such swarms must be much influenced by circumstances, in particular whether more or fewer bees have gone missing in the interim and how many were present at the outset.

15. [How soon after a primary swarm does an afterswarm take place?]

Because weather conditions often hinder the old queen from flying out for some days or even weeks, the afterswarm occurs soon after the primary swarm. If there is no such meteorological hindrance, then the main swarm is probably or certainly a virgin-queen swarm, as the old queen will have failed 14 days earlier. On occasion, an afterswarm takes place unusually late, as the bees commonly construct new queen cells when the first group of queen brood is about to emerge. A queen that has been forced out of the hive or is leaving on a mating flight could presumably land in error at another hive, into which she might be accepted, as an exceptional case. If this occurs, it explains how swarming could take place at a very unusual stage in the colony cycle. By inserting capped queen cells into a hive from which the queen has been removed, I have often induced swarms -- that would hardly occur in less than 14 days under normal conditions -- in half that time if enough worker bees are on hand.

16. [How should we interpret it if a colony does not undertake the usual drone slaughter?]

I am in complete agreement with Dir. Stöhr on this. A hive can also lose its queen in the course of the drone slaughter. In such a case, if another queen mistakenly lands at the hive soon afterwards, she may be accepted by the colony.

17. [Only one queen is tolerated in a colony. Is it the workers or the mother queen that rid the colony of excess queens?]

If it does not occur much more often that two fertile queens meet and then -B as is likely to happen right away -B fall upon each other in a combat that only one can survive, it must be that the workers not only tend to drive out excess adult queens but often open queen cells and destroy them as larvae or pupae. If the queens selected for afterswarms are confined, the supernumeraries are killed.

18. [Are there not instances outside of swarming periods when more than one colony is tolerated?]

This can only be answered in the affirmative. Twice in my own experience, a very old queen with frayed wings was allowed to remain in the hive, even though she had long since been replaced by a younger, fertile queen.

19. [Is it, in fact, well established that bees by nature build their wax combs vertically from the top down?]

Let me respond here with a question. How could the bees extend the nest cavity from below upwards, especially when it is very warm, without having the combs collapse of their own weight, to say nothing of the weight of stored honey and the bees standing on the combs? Where, then, will all the trash fall? Any new space added to the hive, as well as any hole made in its upper part, is rapidly filled by the bees, especially going outward from the warmer upper-middle zone. Even if the entrance hole to the hive is placed at the top, the bees can only do their principal building from above.

The following questions seem especially relevant to problems of seasonal weakness in bee yards:

Of artificial and natural swarms, which are superior?

Under which circumstances is one kind or the other preferred?

What is the maximum lifespan of a queen?

How many eggs can she lay in a lifetime?

What are the maximum and average lifespans of workers?

These are questions of substantial practical importance. A broad discussion of them is very much to be encouraged.

Rev. Dzierzon

Footnote

1. Reference is to the phrase "immunisque sedens aliena ad pabula fucus" (the drone sits down to the feast without paying his share) from Virgil's *Georgics* book 4. Implicit comparison is with the freeloading suitors in Odysseus's household during his absence.